

WHAT IS CLAIMED IS:

1        1. A device for calculating a total amount of toner consumed from a  
2 toner cartridge, the device comprising:

3              a counter, which obtains a first amount of the toner, which is  
4 consumed in a first region of a recording medium at which a toner image is  
5 formed;

6              a timer, which clocks a time period of which the toner cartridge is in  
7 operation;

8              a storage, which stores in advance a second amount of the toner,  
9 which is consumed in a second region of the recording medium at which the  
10 toner image is not formed, the second amount being associated with the time  
11 period; and

12             a calculator, which adds the second amount to the first amount in  
13 accordance with the clocked time period, in order to obtain the total amount.

1        2. A device for calculating a total amount of toner consumed from a  
2 toner cartridge, the device comprising:

3              a counter, which obtains a first amount of the toner, which is  
4 consumed in a first region of a recording medium at which a toner image is  
5 formed;

6              a storage, which stores in advance a second amount of the toner,  
7 which is consumed by forming a test image; and

8              a calculator, which adds the second amount to the first amount, in  
9 order to obtain the total amount.

1       3.     A device for calculating a total amount of toner consumed from a  
2 toner cartridge, the device comprising:

3              a counter, which obtains a first amount of the toner, which is  
4 consumed in a first region of a recording medium at which a toner image is  
5 formed;

6              a storage, which stores in advance a second amount of the toner,  
7 which is consumed for a purpose other than the formation of the toner image  
8 on the recording medium; and

9              a calculator, which adds the second amount to the first amount, in  
10 order to obtain the total amount.

1       4.     The device as set forth in claim 3, wherein the second amount of the  
2 toner includes a toner used for forming a registration mark for placing the  
3 recording medium at a predetermined position.

1       5.     The device as set forth in claim 3, wherein the second amount of the  
2 toner includes a toner used for stabilizing vibrations of a cleaning blade  
3 abutted against a toner carrier.

1       6.     A device for calculating a total amount of toner consumed from a  
2 toner cartridge, the device comprising:

3              a counter, which obtains a first amount of the toner, which is  
4 consumed in a first region of a recording medium at which a toner image is  
5 formed;

6           a first storage, which stores in advance a second amount of the toner,  
7       which is consumed for forming a first test image;  
8           a second storage, which stores in advance a third amount of the toner,  
9       which is consumed for forming a second test image; and  
10          a calculator, which adds the second amount and the third amount to  
11       the first amount, in order to obtain the total amount.

1      7.       The device as set forth in claim 6, wherein the first test image is a  
2       gradation image, and the second test image includes at least a solid image.

1      8.       The device as set forth in claim 6, wherein:  
2           the first storage is provided in a first controller which receives an  
3       image signal from an external device; and  
4           the second storage is provided in a second controller which controls  
5       the formation of the toner image based on an instruction from the first  
6       controller.

1      9.       The device as set forth in any one of claims 1 to 3, wherein:  
2           a plurality of colors of toner are used to form the toner image; and  
3           the second amount is individually determined for each of the colors.

1      10.      The device as set forth in claim 6, wherein:  
2           a plurality of colors of toner are used to form the toner image; and  
3           the second amount and the third amount are individually determined  
4       for each of the colors.

1       11.     A method for calculating a total amount of toner consumed from a  
2 toner cartridge, the method comprising steps of:

3              obtaining a first amount of the toner, which is consumed in a first  
4 region of a recording medium at which a toner image is formed;

5              clocking a time period of which the toner cartridge is in operation;

6              storing in advance a second amount of the toner, which is consumed  
7 in a second region of the recording medium at which the toner image is not  
8 formed, the second amount being associated with the time period; and

9              adding the second amount to the first amount in accordance with the  
10 clocked time period, in order to obtain the total amount.

1       12.     A method for calculating a total amount of toner consumed from a  
2 toner cartridge, the method comprising steps of:

3              obtaining a first amount of the toner, which is consumed in a first  
4 region of a recording medium at which a toner image is formed;

5              storing in advance a second amount of the toner, which is consumed  
6 by forming a test image; and

7              adding the second amount to the first amount, in order to obtain the  
8 total amount.

1       13.     A method for calculating a total amount of toner consumed from a  
2 toner cartridge, the method comprising steps of:

3              obtaining a first amount of the toner, which is consumed in a first  
4 region of a recording medium at which a toner image is formed;

5                   storing in advance a second amount of the toner, which is consumed  
6       for a purpose other than the formation of the toner image on the recording  
7       medium; and

8                   adding the second amount to the first amount, in order to obtain the  
9       total amount.

1       14.       The method as set forth in claim 13, wherein the second amount of  
2       the toner includes a toner used for forming a registration mark for placing the  
3       recording medium at a predetermined position.

1       15.       The method as set forth in claim 13, wherein the second amount of  
2       the toner includes a toner used for stabilizing vibrations of a cleaning blade  
3       abutted against a toner carrier.

1       16.       A method for calculating a total amount of toner consumed from a  
2       toner cartridge, the method comprising steps of:

3                   obtaining a first amount of the toner, which is consumed in a first  
4       region of a recording medium at which a toner image is formed;

5                   storing in advance a second amount of the toner, which is consumed  
6       for forming a first test image;

7                   storing in advance a third amount of the toner, which is consumed for  
8       forming a second test image; and

9                   adding the second amount and the third amount to the first amount, in  
10      order to obtain the total amount.

1       17.     The method as set forth in claim 16, wherein the first test image is a  
2     gradation image, and the second test image includes at least a solid image.

1       18.     The method as set forth in any one of claims 11 to 13, wherein:  
2              a plurality of colors of toner are used to form the toner image; and  
3              the second amount is individually determined for each of the colors.

1       19.     The method as set forth in claim 16, wherein:  
2              a plurality of colors of toner are used to form the toner image; and  
3              the second amount and the third amount are individually determined  
4     for each of the colors.

1       20.     An image forming apparatus, comprising:  
2              the device as set forth in any one of claims 1 to 3 and 6;  
3              a storage, which stores a remaining amount of the toner in the toner  
4     cartridge, the remaining amount is calculated by subtracting the total amount  
5     calculated by the calculator from an initial amount of the toner; and  
6              a judge, which judges a time at which the toner cartridge is replaced,  
7     in a case where the remaining amount becomes a predetermined value or  
8     less.

1       21.     The image forming apparatus as set forth in claim 20, wherein the  
2     predetermined value is selected from a plurality of values one of which is  
3     substantially zero.

1       22.     The image forming apparatus as set forth in claim 20, wherein the  
2     predetermined value is varied in accordance with a rate of an area of the toner  
3     image relative to the recording medium.

1       23.     The image forming apparatus as set forth in claim 20, wherein the  
2     predetermined value is individually determined for each of a plurality of toner  
3     cartridges having different volumes.